LEAVES OF CERTAIN AMARYLLIDS[1]

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(WITH EIGHT FIGURES)

In a previous memoir[2] attention has been drawn to the existence of leaves with a phyllodic type of anatomy among the Amaryllidaceae. In the present paper it is proposed to discuss certain special cases drawn from this family.

Leaf-anatomy of Narcissus

The foliage leaves of *Narcissus* consist typically of a linear limb (fig. 1, *l*) and a short sheathing base (*b*). In the very young leaves the sheath is relatively the more conspicuous organ, while the limb is scarcely developed. This relation is shown in fig. 2, drawn from a leaf which slightly exceeded 1 mm. in length. In *N. Tazetta* L. limbless sheathing leaves occur, in addition to foliage leaves in which both sheath and limb are developed. An examination has been made of the anatomy of the limb in the following species, representing the various sections of the genus:

SUBGENUS EUNARCISSUS

Section AJAX.—*N. Pseudo-narcissus* L.

Section GANYMEDES.—*N. triandrus* L.

Section QUELTIA.—*N. incomparabilis* Mill., *N. Jonquilla* L., *N. juncifolius* Req., *N. reflexus* Lois.

Section GENUINI.—*N. biflorus* Curt., *N. poeticus* L.

Section HERMIONE.—*N. Tazetta* L.

SUBGENUS CORBULARIA

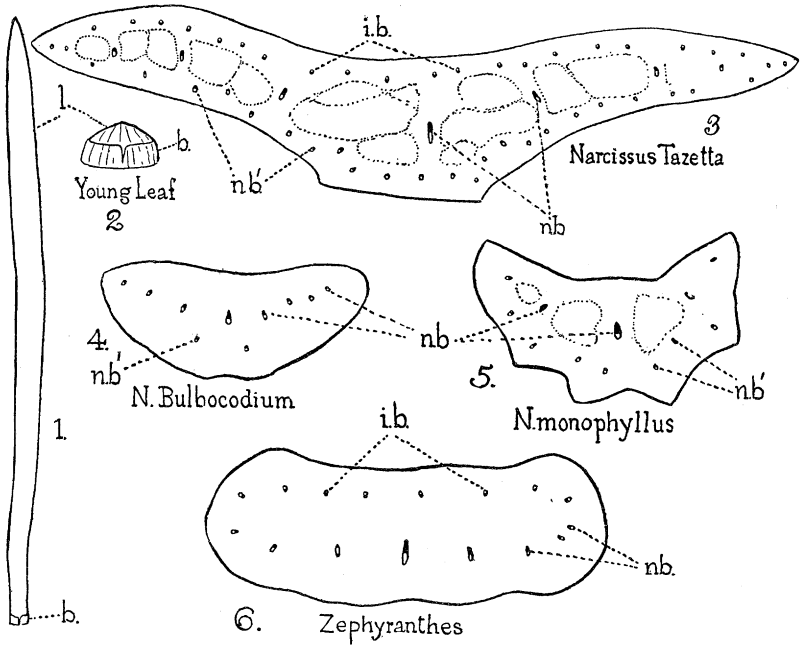
N. Bulbocodium L., *N. monophyllus* T. Moore.

Anatomy of the type interpreted as phyllodic[2] has been found in *Narcissus Pseudo-narcissus*, *N. triandrus*, *N. incomparabilis*,

[1] This paper represents part of the work carried out during the tenure of a Keddey Fletcher-Warr Studentship of the University of London.

[2] ARBER, AGNES, The phyllode theory of the monocotyledonous leaf, with special reference to anatomical evidence. Ann. Botany **32**:465–501. 1918.

N. Jonquilla, *N. biflorus*, *N. poeticus*, and *N. Tazetta;* that is, in at least one species from each of the five sections of the subgenus *Eunarcissus*. The leaf of *N. Tazetta* may be taken as a type (fig. 3). In this species there is a single series of main bundles lying roughly midway between the upper and lower epidermis (*nb*), and a series of smaller bundles lying near the lower epidermis (*nb'*). These

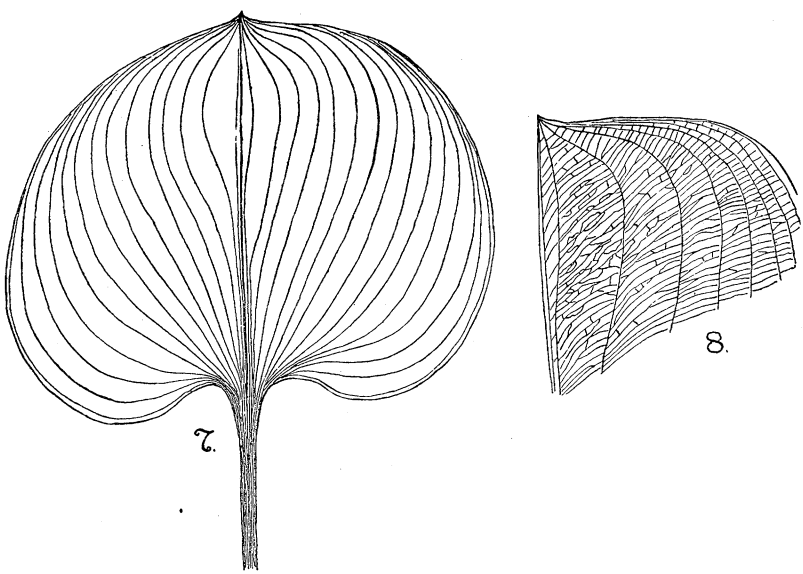


FIGS. 1–6.—Fig. 1, *Narcissus* sp. (garden var.): leaf showing relation of sheath to limb at maturity, ×0.5; fig. 2, *Narcissus* sp. (garden var.): young leaf, slightly more than 1 mm. long showing predominance of sheath; fig. 3, *N. Tazetta* L.: transverse section of limb of leaf, ×14; fig. 4, *N. Bulbocodium* L.: transverse section of limb of leaf, ×23; fig. 5, *N. monophyllus*, T. Moore.: transverse section of limb of leaf, ×23; fig. 6, *Zephyranthes candida* Herb.: transverse section of limb of leaf, ×14; *l*, limb; *b*, sheath; *nb* and *nb'*, series of normally orientated bundles; *ib*, series of inverted bundles (xylem in black, phloem in white, and outlines of lacunae in dotted line).

strands are all normally placed with the xylem upward. In addition there is a series of inverted bundles (*ib*) toward the upper surface. *N. triandrus* has a slender grooved leaf with peripheral bundles, whose xylem faces inward. The leaf anatomy of *N. Tazetta* and

N. triandrus may be compared with that of other Amaryllids in which inverted bundles occur toward the upper surface, as *Zephyranthes candida* Herb. (*Amaryllis nivea* Schult.) (fig. 6). In these cases the structure is interpreted as indicating that the limb is of a petiolar nature.

The only plants belonging to the subgenus *Eunarcissus* in which non-phyllodic anatomy has been found are *N. juncifolius* Req. and *N. reflexus* Lois.; in these all the bundles are normally orientated. This type of structure, however, although apparently rare in



FIGS. 7, 8.—*Eurycles sylvestris* Salisb.: fig. 7, leaf, petiole incompletely shown, ×0.25; fig. 8, small part of righthand side of leaf near apex, ×0.5.

Eunarcissus, is characteristic for the subgenus *Corbularia*. In both *N. Bulbocodium* (fig. 4) and *N. monophyllus* (fig. 5) only two series of bundles are found, both of which are normally orientated; the inverted series toward the ventral surface is absent.

The interest of the leaf anatomy of *Narcissus*, from the standpoint of the phyllode theory, lies in the fact that within the same genus there are examples of phyllodic anatomy (fig. 3), and of a reduced form of anatomy (figs. 4, 5) in which the loss of the inverted bundles results in a structure to some extent simulating that of a

true lamina. That the anatomical type shown in figs. 4 and 5 is indeed a reduction from that shown in fig. 3, and that the series should not be read in the reverse direction, are suggested by the general morphology of the subgenus *Corbularia*. The extreme corona development and the tendency to zygomorphy in the hoop-petticoat daffodil, as CHURCH[1] has suggested, point to its being a more advanced and specialized type than the various forms of *Eunarcissus*.

Pseudo-lamina of Eurycles

The leaf of *Eurycles sylvestris* Salisb. furnishes a very characteristic example of what has elsewhere[2] been described as the "pseudo-lamina" of the monocotyledon. The blade (fig. 7) is large. A herbarium specimen was measured in which it was 19 cm. long by 25.5 cm. wide. Fig. 7 shows that the primary skeletal system of this pseudo-lamina may well be interpreted as originating by the separation of the veins of the distal end of the petiole. The secondary and tertiary venation is also of interest from this point of view (fig. 8). A very large number of the secondary veins are unbranched and unconnected, and it is noticeable that the tertiary veins are extremely irregular; some pass from one secondary vein to another, some go from one secondary vein to a primary; while others leave a secondary vein, form a loop, and return to the vein whence they arose. The anomalous character of this venation seems not inconsistent with the view that the blade of the monocotyledon is an organ which is still at the experimental stage of its evolution from an expanded petiole.

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[3] CHURCH, A. H., Types of floral mechanism. Part I. Oxford. 1908.